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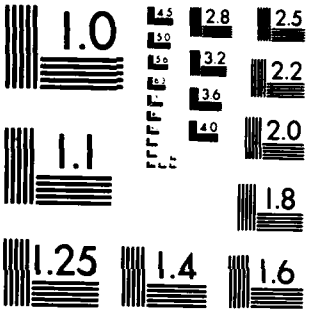

The University of Iowa
Department of Physics and Astronomy
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Annual Letter Report for ONR Contract N00014-82-K-0183
Covering the Time Period 1 December 1981 to 30 November 1982

The primary purposes of the Active Magnetospheric Particle Tracer Explorers (AMPTE) program are (1) to carry out the release and monitoring of lithium and barium ions in the solar wind and within the distant magnetosphere in order to study the access of solar wind ions to the magnetosphere, the convective-diffusive transport and energization of magnetospheric particles, and the instabilities and wave-particle interactions associated with the release and the subsequent evolution of the injected clouds, and (2) to generate a single massive release of barium in the dawn magnetosheath which will create a visible artificial comet in the flowing solar wind plasma within which studies of diamagnetic effects, ionization, momentum exchange, ion transport, and visible phenomena will be made. A complete description of the program is included in the November 9, 1982 volume of EOS, transactions of the American Geophysical Union, Vol. 63, No. 45, pages 843-850. Three spacecraft are involved in the program, a Charge Composition Explorer (CCE), an Ion Release Module (IRM) and the United Kingdom Subsatellite (UKS). The AMPTE program is a collaborative effort involving the United States, the Federal Republic of Germany, and the United Kingdom.

Gerhard Haerendel, of the Max-Planck-Institut für Extraterrestrische Physik (MPE) in Garching, West Germany, principal investigator for the IRM, invited D. A. Gurnett and R. R. Anderson from the University of Iowa to be co-investigators on the IRM plasma wave team. A proposal for the University

of Iowa participation in the AMPTE project was submitted to the Office of Naval Research and subsequently funded under contract N00014-82-K-0183.

A block diagram of the University of Iowa AMPTE IRM Plasma Wave experiment is shown in Figure 1. The University of Iowa will provide all of the hardware indicated in the block diagram with the exception of the Fairchild Antenna which was purchased by MPE. The hardware to be provided include a spare HELIOS plasma wave electric field experiment, a high frequency receiver, a wideband receiver, electric field antenna preamplifiers, antenna control electronics, and a power supply. A summary of our effort over the past year in preparing these units for the AMPTE project follows.

HELIOS UNIT

The spare HELIOS plasma wave electric field instrument was modified to be compatible with the IRM spacecraft and then bench level tested at the unit level. The unit has successfully completed preliminary integration testing at MPE. During the testing a minor intermittent problem with one of the 16 channels was noted. While the instrument was being stimulated, the output of the 311-Hz channel occasionally would drop below what it was supposed to be. This intermittent problem will be investigated at Iowa as soon as a second set of HELIOS ground support equipment (GSE) can be built up from existing spare HELIOS GSE components. (Due to large transportation costs, the original HELIOS GSE has been left at MPE for future tests.) Because the channel in question does not drastically affect the overall performance of our instrument and because of the potentially larger problems associated with dismantling an

already completed and conformally coated instrument, we do not intend to repair the 311-Hz channel unless it can be done easily and safely or unless the investigation shows that the problem could ultimately affect other channels. Following completion of this task and prior to final experiment integration at MPE, the unit will be subjected to environmental testing (temperature and vibration) at Iowa.

HFR-WBR UNIT

The high frequency receiver (HFR), wideband receiver (WBR), and power supply comprise a second separate unit known as the HRF-WBR unit. All the design and electronic packaging of the HFR-WBR unit have been completed and an electrical interface equivalent unit has completed preliminary integration at MPE. Compatibility testing between the wideband system and the IRM telemetry system demonstrated the need for additional filtering to prevent mutual interference between the wideband data at baseband and the spacecraft digital data at 131 kHz. Iowa will provide a low-pass filter in our wideband output electronics and the spacecraft is to add a high pass filter to its output electronics. All electronic modules have been mounted on test motherboards and the board and module design has been electrically confirmed. A majority of the flight modules have been built and the interboard connector harness design has been completed. The motherboards are presently undergoing board and system level integration in the harness test jig. The spacecraft simulator portion of the GSE is complete and is being used for the system level integration. Work is proceeding on the antenna stimulation section of the GSE. The fabrication drawing for the housing is nearing completion.

The following tasks remain on the HFR-WBR unit before delivery and integration scheduled for July 1983: (1) machining and gold plating the housing, (2) fabricating and installing the flight harness, (3) completing fabrication of remaining flight modules, (4) building and testing flight boards and integrating them in housing, and (5) conducting temperature and vibration environmental testing of unit.

ELECTRIC FIELD ANTENNA PREAMPLIFIER UNIT

The flight unit AC and DC preamps, antenna control electronics, Aerospace preamps, and the prototype HFR preamps have been installed in the flight preamp housing and the unit has completed preliminary integration at MPE. Current spikes from the antenna control electronics were discovered during pre-integration, and a filter scheme was developed to suppress them. Tasks remaining before flight integration include (1) returning unit to Aerospace for rework on their preamps, (2) building the flight HFR preamps and installing them in the unit, and (3) conducting temperature and vibration environmental testing of the unit.

An integration, test, and calibration of the complete instrument will be performed at Iowa before delivery to MPE in July 1983 for integration onto the flight spacecraft. After instrument delivery to MPE we will support the spacecraft environmental, RFI-EMC, and antenna extension tests. We will also support prelaunch checkouts of our instrument after the spacecraft is shipped to Cape Canaveral.

As part of the hardware phase of the project we have generated an experiment description document and a spacecraft interface/harness and

connector document. In preparation for the post-launch activities, we have participated in the planning for post-launch data displays and data exchange and analysis.

During the past year, travel was required as part of the AMPTE project in support of the following activities: (1) AMPTE Science Working Group meeting in Palo Alto, California, and IRM Plasma Wave Experimenters' meeting in Los Angeles in February, 1982, (2) final acceptance tests for the Fairchild antenna in Germantown, Maryland in June, 1982, (3) AMPTE Science Working Group meeting in Garching and AMPTE Joint Working Group Meeting in Oberpfaffenhofen, West Germany in June, 1982, and (4) pre-integration of the University of Iowa plasma wave experiment at MPE in November, 1982.

At this point in time, our part of the AMPTE project appears to be operating on schedule and we do not anticipate any major or insurmountable problems.

Submitted by:

Roger R. Anderson
January 20, 1983

C-G81-427

UNIVERSITY OF IOWA AMPTE IRM PLASMA WAVE EXPERIMENT

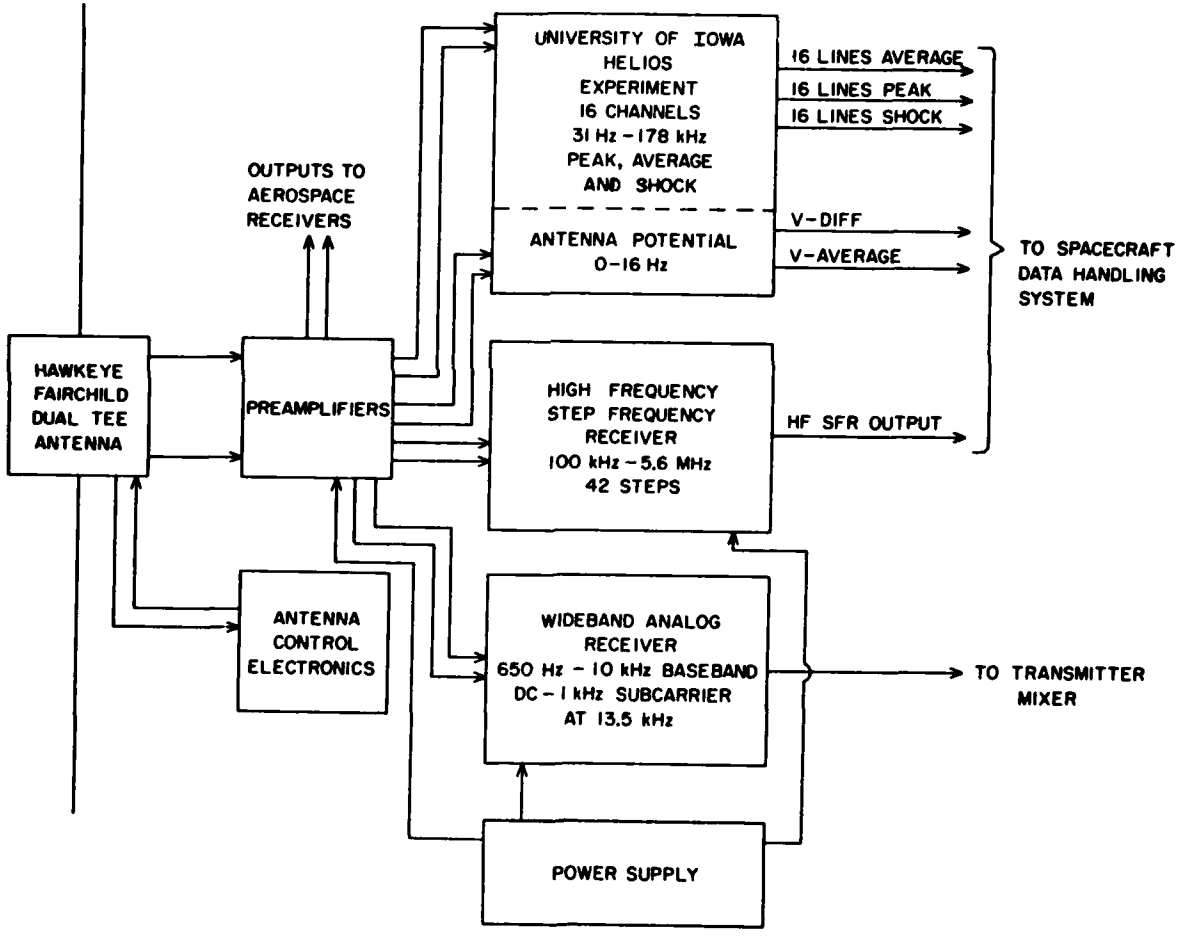
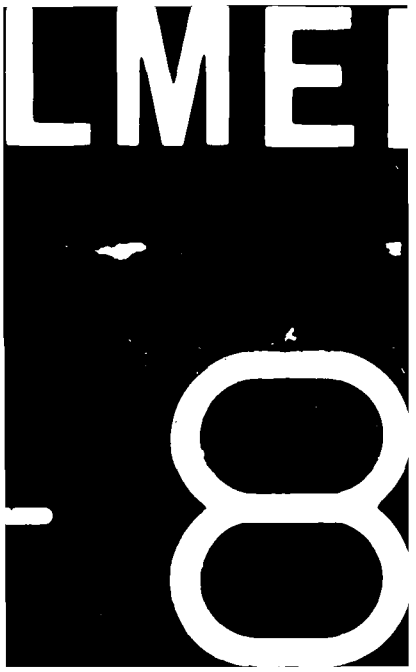


Figure 1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